UNIVERSITI TEKNOLOGI MARA

WIRELESS FIRE DETECTION SYSTEM WITH GIS TECHNOLOGY FOR FIRE AND RESCUE APPLICATION

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AUTHOR'S DECLARATION

I declare that the work in this thesis/dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification..

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ABSTRACT

The mission of the Fire and Rescue Service is to protect lives, properties and natural resources from fire and other emergencies. With increasing demands, the Fire and Rescue Service must utilize the best tools, techniques, and training methods to meet public expectations. As a result, three-Dimensional (3D) city and building models for Fire and Rescue Applications have become an important part of Geographic Information Systems (GIS) analysis. Many airports, office buildings and department stores have complex floor plans. In such environments,most of normal map is not sufficient and time consuming in helping the Fire Fighter to navigate during fire emergency. To overcome this problem, a 3D network analysis of a building for Fire and Rescue Applications which is based on a 3D model of Faculty of Electrical Engineering building (FKE) in MARA University of Technology (UiTM), Shah Alam were designed based on a 3D model. This 3D network analysis model identifies the shortest path from the Fire and Rescue Service position to the source of emergency. It also designs a wireless fire detection system to help fire-fighters to pinpoint the emergency call location, assess the potential consequences, and determine the most efficient strategy. The 3D model was built by Google Sketch Pro 8 and the 3D network analysis was mainly conducted in the ESRI's ArcGIS software. The wireless fire detection systems were designed using Arduino Microcontroller. The 3D network analysis was based on distance measurements instead. The distance of each path was measured on the site personally for maximum accuracy. The fire detection systems prototype hardware are equipped with smoke sensor, image sensor, a transmitter and a receiver. This thesis is expected to help the Fire and Rescue Service in their mission by providing the shortest path to the source of emergency and hopefully, it will help in improving their response, adequate planning and preparedness. As a result, 3D map from GIS will help the fire fighter in their navigation in complex and confuse building plan. Information on Geographical feature for example route length and estimated time of arrival provided in the map will be beneficial in emergency operation. The fire fighter will also get the inside visual and the location of emergency area as the image and smoke sensor were both installed in the wireless fire detection device.

TABLE OF CONTENT

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Fire alarm systems have been used for many years. Range of the fire alarm can be a from simple 1 or 2 zone systems, to systems big and complex with over 100 zones. The largest panel would be used to cover up more field.Conventional detection fire alarm system offers a good basic system, best for small applications, or projects on a small budget.The detectors in a are of the floorplan are all connected to the same pair of wires. If any of these detectors triggered an alarm, a single indication is shown on the control panel, meaning that the exact location of the alarm is not shown.The sounders (including sounder bases) are wired on a separate circuit. In order to reduce a separate circuit accident, Wireless Sensor Network (WSN) are widely used nowadays. Wireless Sensor Network (WSN) is a collection of node distribution that is capable in operating with the presence of minimal user whereby one user can monitor several nodes. WSN can be the most useful way to collect various parameters and all the information needed by environments. It combines computer and Communication technology with the technology of a sensor network, which is considered to be one of the ten emerging technologies that will affect the future of human civilization. This network is composed of numerous and ubiquitous micro sensor nodes which have the ability to communicate and calculate. These nodes can monitor sense and collect information of different environments and various monitoring objects cooperatively.

WSN can be the most useful way to collect various parameters and all the information needed by environments such as in industrial, shipboard, home, building, utilities and transportation system automation. However, the sensor has resources constraints which include the battery life, communication bandwidth, CPU storage and capacity [1]. The main function of wireless sensor network is to determine the environmental conditions that are monitored by sensing some physical event. Sensor network basically consists of a large number of sensor nodes deployed in a large physical area to monitor and track the activities of real-time environment. The sensor node is a basic unit and platform of the wireless sensor network. A sensor node is commonly comprises of four modules: sensing module, a processing module, a